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ABSTRACT

A study examined how preschool children use information about linguistic contrast in learning new words. The 72 subjects were assigned to four groups to play a game. They were asked to get an unfamiliar item, one of nine swatches of different colors, shapes, and materials. In the first group, the children were told only one label (color, shape, or material), and in the other three groups, the objects were identified by a novel word contrasted with two familiar words from the same semantic domain (e.g., "it's not yellow, it's not green; it's mauve"). Five tests (sorting, hyponym, color identification, material identification, and shape identification tasks) were then administered to discover what the children thought their new words meant. Results suggested that some of the novel words introduced corresponded to concepts the children already had names for (e.g., "green" to identify "chartreuse"). It was concluded that children may deal with new information in word learning by making the most of whatever information seems to make sense, given their prior knowledge and beliefs, while quickly ignoring or forgetting the rest. (MSE)

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Children's Use of Information in Word Learning

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Children are constantly bombarded with information about new word meanings. Whenever they hear a novel word, the context supplies information about its meaning--more, probably, than they can ever keep track of. How do they cope? One strategy may be to make the most of whatever seems to make sense, given their prior knowledge and beliefs, while ignoring, or quickly forgetting, the rest. Obviously, if children process information in this way, they run the risk of wasting pertinent information. But they also stand a chance of using pertinent information very efficiently. This work examines whether or not children children's knowledge and beliefs about word meanings may affect their use of information in word learning. Central to the discussion are two general ideas that children seem to have about word meanings. First, some possible meanings look more plausible than others. Second, different words mean different things.

Preferences. Children seem to have preferences that are specific to word meanings. For example, they often interpret a new word as a label for an object category or a shape rather than as a label for a color, a substance (Au, 1985; Baldwin, 1986; Clark, 1973; Dockrell, 1981; Dockrell & Campbell, 1986; Macnamara, 1982; Soja, Carey, & Spelke, 1985; Taylor & Gelman, 1988), an object part (Markman and Wachtel, in press), or a thematic relation (Markman & Hutchinson, 1984). This preference persists even for adults (Au, 1985), and it does not appear in comparable situations where no novel term is introduced (Baldwin, 1986; Markman & Hutchinson, 1984). Both children and adults also have a material-over-color preference that seems to be specific to word meanings (Au & Markman, 1987).

The Principle of Contrast. Most, if not all, linguists hold that different words mean different things (e.g., Bolinger, 1977; Palmer, 1981). To capture this intuition, Clark (1983, 1987) proposes the Principle of Contrast which states that every two forms contrast in meaning. There is some evidence that children do honor this principle in their word uses. Consider overextension. For example, young children sometimes apply the word *dog* not only to dogs, but also to other four-legged mammals such as cats, sheep, horses, and cows (Clark, 1973). When they acquire *horse*, they tend to stop overextending *dog* to horses, although they may still overextend it otherwise (Barrett, 1978; Leopold, 1949). This is just what young children should do if they think that a new word (e.g., *horse*) should contrast in meaning with the words that they already know (e.g., *dog*). See Clark, 1983, 1987, for more thorough reviews of the evidence.

Use of Information in Word Learning. It seems plausible, then, children think that some hypotheses are better than others and that different words mean different things. How may these ideas affect the way children use information in word learning? This discussion will focus on one kind of information that children often encounter, namely, linguistic contrast.

If children know how a new word is related in meaning to a familiar word, they may be able to narrow down the set of possible meanings tremendously. One way children may map a new word onto an appropriate semantic domain is to hear it contrasted with a familiar word from the same domain. For instance, if they know that *red* is a color word, and they hear a new word such as *beige* contrasted with *red*, they may infer that *beige* is also a color word. Children often hear adults contrast words explicitly when the adults correct the children's errors (cf. Brown & Hanlon, 1970). For example, when a child calls a muffin a cookie, the parent may say, "No, that's not a cookie. That's a muffin." In these cases, the contrasting words virtually always belong to the same semantic domain.

Au and Markman (1987) examined how children use this kind of linguistic contrast in

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word learning. In that study, some children simply heard a novel word applied to a square swatch. (E.g., "Can you bring me the rattan [or mauve] square? See--this is rattan [or mauve].") These children seemed to favor material over color in their hypotheses about the new word meaning. Other children received additional contrastive linguistic information. (E.g, "This is not wood, and this is not cloth. This is rattan." Or "This is not red, and this is not green. This is mauve.") When the information confirmed the preferred hypothesis--that the novel word referred to the material of the square--children were more likely to interpret their new word as a material name than the children who did not hear the linguistic contrast. However, when the information did not confirm their preferred hypothesis, children acted as if they did not hear it. That is, children who heard the novel word contrasted with two familiar color names responded much like those children who were not given any linguistic contrast.

An important question remains open is why children can use linguistic contrast effectively only in some situations. For instance, it is possible that in general children can take advantage of pertinent information only if it supports their favored hypothesis, such as material. But it is also possible that children can make use of pertinent information in most cases, and they fail to do so only when it supports a hypothesis that they believe to be wrong. That is, they failed to use linguistic contrast to learn a color name because for some reason they had a bias against color. One possible reason for such a bias is that categories named by color words do not have sharp boundaries. As a result, children usually have a color word that can be readily stretched for referring to a color they do not yet have a name for. So if children believe that words should contrast in meaning, they may think that a novel term, such as *mauve*, cannot refer to the color of the object to which the term is applied because they believe that a familiar term, such as *purple*, refers to that color. In other words, a familiar color name may stand in the way when children have the opportunity to learn a new one. In short, perhaps children can usually benefit from linguistic contrast--or other kinds of pertinent information--in word learning. However, they may fail to do so if the information supports a hypothesis that they deem wrong on the basis of their prior knowledge and beliefs about word meanings.

The present study examined how children's ideas about word meanings may affect their use of contrastive linguistic information in three domains: color, material, and shape. It focused on (1) children's preferences for certain hypotheses about word meanings, and (2) their belief that different words mean different things. A novel color, material, or shape name was introduced to each child. Some children simply heard their novel word applied to an object. Other children got additional contrastive linguistic information pertinent to the new word meaning.

Recall that Markman and I found that children preferred material to color in their hypotheses about a new word meaning. And previous studies of word learning suggest that children favor shape or object category over material (Soja et al., 1985; Taylor & Gelman, 1988). Therefore, children in the present study were predicted to favor shape over material over color. If so, it would be possible to see if children still used linguistic contrast about material even when material was not their preferred hypothesis, or if it was no longer helpful--like linguistic contrast about color in Au and Markman's study. Also, as discussed earlier, it seems that children may fail to use pertinent contrastive linguistic information to learn a novel color name because a color name they already know preempts a color interpretation for the novel word. In this study, it was possible to look again if such preemption does occur not only in the domain of color, but also in the domains of material and shape.

Method

Subjects

Seventy-two children from six preschools in northern California participated in this study. There were 29 girls and 43 boys. They ranged in age from 3;1 to 5;0 (mean age 4;2).

Stimulus Materials

The objects used for teaching children new words were swatches of different colors, materials, and shapes. Three kinds of material and three shapes were used with their appropriate names (*acrylic, plush, rattan; crescent, elliptical, trapezoid*) in the introducing event. Altogether there were nine stimulus swatches, including all possible combinations of these materials and shapes, each in a different color. The nine color words included *annato, celadon, chartreuse, fiesta, flaxen, infantry, leghorn, mauve, ocher*.

Procedure

There were four conditions: Label Only, Color Name Contrast, Material Name Contrast, Shape Name Contrast. The children were randomly assigned to the four conditions, with 18 per condition, approximately balanced for age and sex. The mean ages for the four conditions were 4;1, 4;2, 4;2, and 4;2, respectively.

Children were asked individually to come play a game for about ten minutes in a quiet corner of their school. Each of the nine stimulus figures was used for introducing one new word to two children per condition (one 3-year-old and one 4-year-old). The mauve rattan elliptical swatch can illustrate the procedure.

In the *Label Only Condition*, as a child approached the game table, I would point at a swatch a few feet away and ask, "Can you bring me the mauve [or rattan or elliptical] thing?" When the child handed me the swatch, I said, "See, it's mauve [or rattan or elliptical]." Six children heard a novel color name; six, a novel material name; and six, a novel shape name. These three kinds of names were randomly assigned to children, approximately balanced for age and sex.

In the other three conditions, children heard a novel word contrasted with two familiar words from the same semantic domain. In the *Color Name Contrast Condition*, a child might hear, "Can you bring me the mauve thing?" and then, "See, it's not yellow, and it's not green. It's mauve." In the *Material Name Contrast Condition*, a child might hear, "Can you bring me the rattan thing?" and then, "See, It's not paper, and it's not cloth. It's rattan." In the *Shape Name Contrast Condition*, a child might hear, "Can you bring me the elliptical thing?" and then, "See, it's not square, and it's not triangular. It's elliptical."

Testing Procedure. The testing session began about one minute after a child had heard a new word. Five tests were designed to find out what the children thought their new word meant.

(1) *Sorting Task*. In this task, the child saw four sets of four swatches. Each set included a "target swatch," namely, the swatch used in the introducing event (e.g., the mauve rattan elliptical swatch). Each set also included three other geometric figures: a color-associate (e.g., a *mauve* paper square), a material-associate (e.g., a green *rattan* square), and a shape-associate (e.g., a green paper *ellipse*). For each set of four swatches, the child would hear, "Is there a mauve [or rattan or elliptical] one here?" depending on which new word was introduced to the child earlier. If the child chose one, the child would then be asked, "Is there another mauve [or rattan or elliptical] one here?" Thus it was possible to see if the child chose the swatches on the basis of color, material, shape, or some other criterion.

(2) *Hyponym Task*. The child saw a blue paper square and heard, "It's not mauve [or rattan or elliptical] because it's...." The rationale for this test was that if the child thought *mauve* (or *rattan* or *elliptical*) was a color word, the child might say, "because it's blue." If the child thought it was a material word, the child might say, "...because it's paper." If the child thought it was a shape word, the child might say, "...because it's square."

(3) *Color Identification Task*. The child saw ten color chips including the non-focal colors chosen for the stimulus squares. The child was asked, "Is there a mauve [or rattan or elliptical] one here?" If the child chose a chip, I would ask, "Is there another mauve [or rattan or

elliptical] one here?''

(4) *Material Identification Task.* This task was identical to the Color Identification Task except that, instead of ten color chips, the child saw ten rectangular swatches of ten different materials including acrylic, plush, rattan, and sponge.

(5) *Shape Identification Task.* This task was identical to the previous two tasks except that the child saw ten paper swatches in various shapes including elliptical, trapezoid, pentagonal, and round.

Assessment of Availability of a Familiar Word

Another group of 3- and 4-year-olds were asked to name the colors, materials, and shapes of the nine swatches used for introducing novel words in this study. The questions used in these naming tasks were: ''What color is this?'' ''What is this stuff?'' and ''What shape is this?'' The naming responses could then be used for estimating to what extent the other children in this study--those who heard a novel word applied to one of these swatches--believed they knew the names for the color, material, and shape of their swatch. Naming responses were collected from 14 children. These children came from one of the six preschools that participated in the word-learning portion of this study. Altogether there were six girls and eight boys. They ranged in age from 3;2 to 4;11 (mean age 4;3). The order of these naming tasks was randomized and counterbalanced across children.

Results and Discussion

Three main findings are of interest. The first concerns whether children prefer some hypotheses about the semantic domain of a new word, such as shape, over others, such as color. The second has to do with children's ability to use linguistic contrast to induce the semantic domain of a new word. The third concerns children's beliefs about the adequacy of their vocabulary.

Preferences. This study reveals that children have a strong preference for shape in hypotheses about word meanings (see Table 1). This is consistent with findings in previous studies (Au, 1985; Baldwin, 1986; Clark, 1973; Dockrell, 1981; Dockrell & Campbell, 1986; Macnamara, 1982; Markman & Hutchinson, 1984; Soja et al., 1985; Taylor & Gelman, 1988).

TABLE 1: Mean Percentage of Responses Suggesting Various Interpretations

INTERPRETATION	CONDITION				OVERALL
	Label Only	Color Name Contrast	Material Name Contrast	Shape Name Contrast	
Shape Name	52	33	42	67	49
Material Name	27	27	50	22	31
Color Name	21	39	18	22	25

Children in the Label Only Condition gave more responses that suggested a shape name interpretation (52%) than a color name interpretation (21%), matched $t(17) = 3.34$, $p<.05$, two-tailed. There was also a trend toward giving more responses suggesting a shape name interpretation than a material name interpretation (27%), matched $t(17) = 2.03$, $p<.06$, two-tailed. The way these percentages were determined can be illustrated using the shape name interpretation as an example. In the Sorting Task, to be counted as having this interpretation, children had to choose members in the four sets of swatches on the basis of shape. In the Hyponym Task, they had to respond, ''This is not X because it's square'' (where ''X'' represents their new word). In the Color and Material Identification Tasks, they had to deny that any of the

color chips or swatches could be named by the new word. In the Shape Identification Task, they had to choose only the shape identical to the shape of the stimulus swatch originally referred to by the new word in the introducing event. If children refused to choose any shape or chose more than one shape haphazardly, they were not credited as selecting on the basis of shape.

Unlike what Au and Markman found earlier, this study revealed no reliable preference favoring material over color. In this study, children who heard a novel term applied to an object did not give reliably more responses that suggested a material name interpretation (27%) than a color name interpretation (21%), matched $t(17) = .86$, $p>.3$, two-tailed. Perhaps children's preference for shape was so strong that it pulled children away from considering material as a hypothesis for the new word meaning. Note that Au and Markman probably preempted a shape name interpretation by introducing the novel word with a square swatch and calling it "an X square" (where "X" represents the novel term).

Use of Information. Au and Markman also found that children favored material over color in hypotheses about word meanings, and that they could benefit from linguistic contrast to learn a material name but not a color name. As discussed earlier, this pattern of results could occur if (1) children generally can benefit from pertinent information only when it supports a favored hypothesis, or (2) children generally can benefit from pertinent information except when it supports a hypothesis in strong disfavor. The findings of this study went against the first possibility. Specifically, children showed a strong preference for shape over material and color in their hypotheses about word meaning. But they benefited little from linguistic contrast such as "It's not square, and it's not triangular. It's elliptical," in learning a new shape name. On the other hand, they did benefit from linguistic contrast such as "It's not paper, and it's not cloth. It's rattan," in learning a new material name. These findings were revealed by three analyses.

The first analysis computed, for each child, the percentage of responses that suggested a shape name interpretation, with the five tests combined and equal weight given to each test. These data were first submitted to a 4 X 2 X 2 (Condition X Age X Sex) ANOVA. This analysis revealed a reliable Condition effect ($F(3,56) = 3.26$, $p<.05$) and no age or sex differences. But this Condition effect did not generalize across stimuli, as shown by a 4 X 9 (Condition X Stimulus) ANOVA, $F(3,24) = 2.6$, $p>.05$. Children who heard their new word contrasted with two familiar shape names gave somewhat more responses that suggested a shape name interpretation (67% in the Shape Name Contrast Condition) than those who heard their new word applied to an object but heard no other information about its meaning (52% in the Label Only Condition). However, the difference was not reliable, $t(56) = 1.39$, $p>.1$, two-tailed. These results show that linguistic contrast such as "It's not square, and it's not triangular. It's crescent," did not reliably help young children learn a shape name even though it confirmed their preferred hypothesis.

The second analysis revealed that linguistic contrast such as "It's not paper, and it's not cloth. It's rattan," helped children overcome their shape-over-material preference to induce a material name meaning. This directly paralleled the shape name interpretation analysis. It revealed a reliable Condition effect that generalized both across children and stimuli (across subjects: $F(3,56) = 3.96$, $p<.02$; across stumuli: $F(3,24) = 4.38$, $p<.03$). Children who heard their new word contrasted with two familiar material names gave more responses that suggested a material name interpretation (50% in the Material Name Contrast Condition) than those who heard their new word applied to an object and heard no other information about its meaning (27% in the Label Only Condition). This difference was reliable both across subjects ($t(56) = 2.52$, $p<.02$, two-tailed) and across stimuli ($t(24) = 2.75$, $p<.02$, two-tailed). In short, children took advantage of linguistic contrast with material names even though it did not confirm their preferred hypothesis.

The third analysis revealed that children who heard their novel word contrasted with two familiar color names gave more responses that suggested a color name interpretation (39% in the Color Name Contrast Condition) than those who only heard the novel word applied to an object but got no contrastive information (21% in the Label Only Condition), $t(56) = 2.43$, $p<.02$, two-tailed. But this result did not generalize across stimuli, post-hoc matched $t(8) = 1.67$, $p>.1$, two-tailed.

In sum, while children seemed to prefer shape in hypotheses about word meanings, they did not benefit much from information that supported this preferred hypothesis. And while material did not seem to be particularly favored as a hypothesis in this study, children took advantage of information supporting this hypothesis. It does not seem, then, that children are always better at using pertinent information consistent with their favored hypotheses than at using information inconsistent with them. From here on, the analyses will examine the second possible explanation for Au and Markman's findings, namely, that children often fail to benefit from pertinent information in word learning when it supports a hypothesis in strong disfavor.

Beliefs about the Adequacy of Their Vocabulary and Use of Information. If children believe that different words mean different things, they should resist learning a new word that overlaps very much in meaning with a word they already know. Because of such resistance to apparent synonyms, children may sometimes fail to benefit from pertinent information about new word meanings. In order to examine this possibility, 14 3- and 4-year-olds were asked to name the colors, materials, and shapes of nine stimulus swatches. Their ability to come up with a name and their response latencies were used to estimate to what extent 3- and 4-year-olds felt that they already had names for these colors, materials, and shapes. When asked to name the rattan, plush, and acrylic materials, these 14 children often said they did not know what the material was. They did so for 41% of the trials, compared to 8% of the trials with the eight nonfocal colors (matched $t(13) = 4.96$, $p<.0001$, two-tailed). It also took children longer to offer answers during the material naming trials. For acrylic, plush, and rattan, children took on the average about 6.7 seconds before they responded, compared to about 2.5 seconds for the eight nonfocal colors (matched $t(13) = 4.81$, $p<.0001$, two-tailed). Note that children also benefited reliably from pertinent linguistic contrast for learning the names for these three kinds of material. They were less consistent in using pertinent linguistic contrast to learn the names for the colors.

The naming data for the shape items were more varied. Children seemed to find the trapezium hardest to name, followed by the ellipse. They named the crescent shape--they usually called it "moon"--extremely readily. Some item analyses were performed in order to understand these data better. It would be desirable to do comparable analyses on the color and material naming data. But unfortunately, because only two children heard each novel color name contrasted with familiar color names, the sample size was too small for making inferences about individual color items. So from here on, the analyses will focus on how much children benefited from pertinent linguistic contrast in learning the names for the material and shape items.

The analyses first computed the benefit of pertinent contrastive linguistic information, based on children's responses in the word learning task. For the material items, this meant the difference between the Label Only and Material Name Contrast Conditions in percentage of responses suggesting a material name interpretation. For the shape items, this meant the difference between the Label Only and Shape Name Contrast Conditions in percentage of responses suggesting a shape name interpretation. There were six children per item per condition. The variance in the data differed considerably from item to item, by as much as a factor of 7.4. So these analyses used the t-statistic of the increase in percentage of correct responses to estimate the benefit of linguistic contrast. Each t-statistic showed how much pertinent linguistic contrast encouraged an appropriate interpretation for each novel word, with

the variance in the data for each item adjusted to the same standard.

TABLE 2: Responses in the Naming Task and the Word Learning Task

Item	Naming Task		Word Learning Task		
	%"Don't Know."	Latency (seconds)	Benefit of Pertinent Linguistic Contrast		
			%Increase in Correct Responses	$t(10)$	p-level
rattan	29	6.8	27	1.39	.20
plush	36	6.3	30	1.50	.17
acrylic	57	7.2	16	2.08	.065
crescent	7	2.6	10	.46	.66
elliptical	36	5.2	20	.56	.59
trapezoid	71	6.1	43	2.21	.052

The benefit of pertinent linguistic contrast, as estimated by the t-statistics, was reliably related to how often another group of children failed to name the items (Pearson $r(4)=.86$, $p<.05$, two-tailed). The benefit was also marginally related to the response latency data (Pearson $r(4)=.77$, $p<.1$, two-tailed). These findings suggest that young children are better at using pertinent information to learn a new label for something if they do not already have a ready label for it than if they do. In the latter case, a familiar word meaning may stand in the way when children try to learn the new word meaning because children tend to resist synonyms.

Conclusions

In this study, some of the novel words introduced to the children seemed to pick out concepts that young children have ready labels for. For example, 3- and 4-year-olds seemed quite happy to name the colors of the stimulus swatches with color names already in their repertoire such as *purple* (for mauve), *green* (for chartreuse), *white* (for flaxen), and so on. They also seemed quite willing to call the crescent shape "moon." It is perhaps not mere coincidence that young children at this age also frequently failed to take advantage of pertinent contrastive linguistic information in learning novel names for these colors and shapes. In fact, this study suggests that children's success in using pertinent information to learn a new word meaning may be affected by their knowledge of other word meanings. Quite probably, children are most successful when they do not already know a word that has roughly the same meaning as that implied by the information.

To conclude, children may deal with the barrage of information in word learning by making the most of whatever seems to make sense, given their prior knowledge and beliefs, while ignoring, or quickly forgetting, the rest. They seem to find some hypotheses more plausible than others and rely on such preferences to pick out their initial favored hypotheses. Their idea that different words mean different things also seems to affect how they make use of pertinent information. When they hear a novel term, they tend to look for an as-yet-unnamed category as a candidate for the new word meaning. No doubt, children run the risk of wasting pertinent information if they only take advantage of information that makes sense to them according to their prior knowledge and beliefs. On the other hand, by being selective in taking in the information available to them, they may avoid being overwhelmed by information. Perhaps no less importantly, they also stand a chance of using pertinent information very efficiently.

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